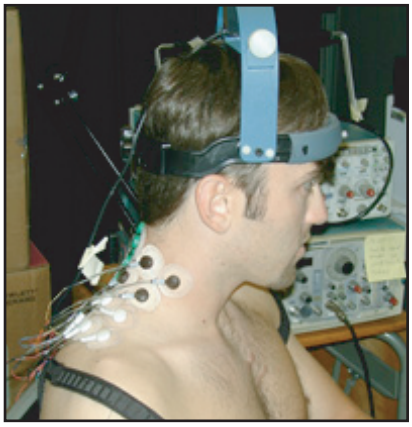
Human Factors

research and technology division

Using EMG to Predict Head Motion for Virtual Reality Applications

Objective

In Virtual Environment (VE) applications, virtual images must be continuously stabilized in space against the user's head motion. Latencies in the head-stabilization loop cause virtual images to swim around, thus defeating applications such as telerobotics, air-traffic control and surgery simulation. These latencies are mostly due to delays in sensing head motion with inertial sensors (accelerometers and rate gyros). Our objective is to anticipate these latencies in order to cancel them out.



Approach

Electromyogram signals (EMG) from muscles precede their exertion of force, thus limb or head acceleration. For neck muscles, the delays are about 30 milli-seconds. We thus expect to gain a comparable lead time by using EMG in the VE stabilization loop instead of inertial sensors. There are about 30 muscles involved in head motion and in a very complex way. We thus forgo any attempt to isolate the effect of each muscle separately, and instead consider the pattern of EMG activities as collected by a set of up to 32 electrodes placed around the neck. We are interested in solving this many-to-six (32 EMG signals-to-inertial linear and angular accelerations) real-time pattern-recognition problem.

Impact

Achieving the above goal could reduce or eliminate the currently encountered latencies, and thus help make VE a more viable technology, especially for see-through applications. In addition, it would be directly applicable to many other human-machine interactions

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